



Commercial Aviation Halon Footprint

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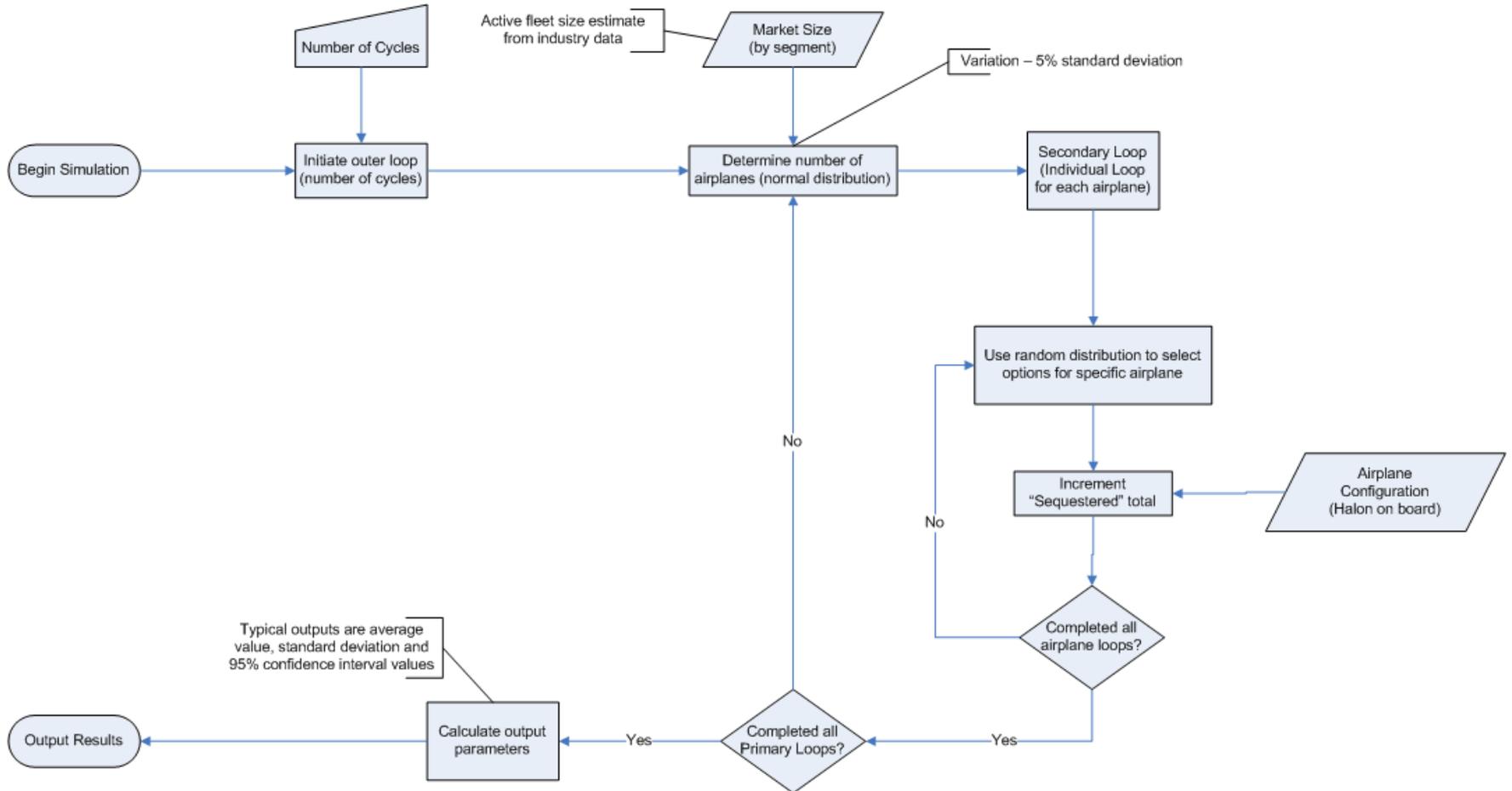
Purposes of the Model

- Investigate size of Halon market
 - How much is the industry carrying around?
 - How much will be carried in the future?
 - How much is actually being released into the atmosphere?
 - How much is needed to sustain the fleet, and how much is needed to maintain deliveries from airframe manufacturers?
- Investigate feasibility of relying on current Halon stocks
 - What is the change in “installed demand”?
 - How much difference will improvements in systems design make?
 - What would be the impact of altering bottle servicing rules?

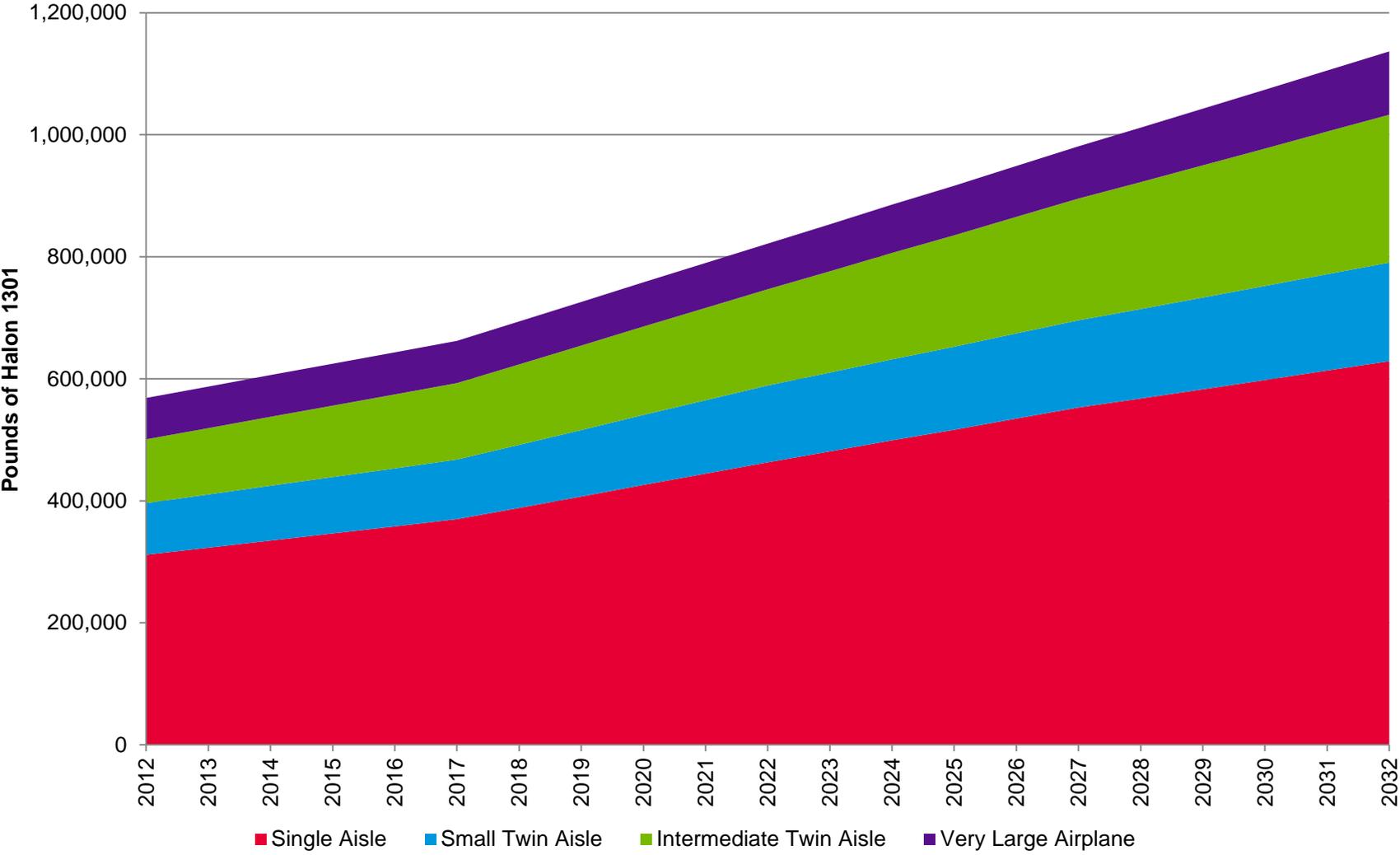
Assumptions and Features of the Model

- Detailed simulation of 20-year period
 - Airplane discharges tracked on a per flight basis
 - Discharge rates based on field service data
 - Airplane utilization rates based on field service data
 - Recycling losses tracked on a per bottle basis
 - Halon recycled is based on field data regarding bottle service rates
 - Losses estimated at one percent of Halon transferred per servicing event
 - Losses do not account for transfers outside of aviation
- Monte Carlo method used with several variables
 - Overall fleet size
 - Airplanes over 100 seats (no regional jets)
 - Market broken into four segments (single aisle, small and intermediate twin aisle, and very large airplanes)
 - Individual airplane usage rates
 - Distribution based on in-service data
 - Field data incorporates multiple models to determine segment, not particular airplane usage
 - Airplane configuration options

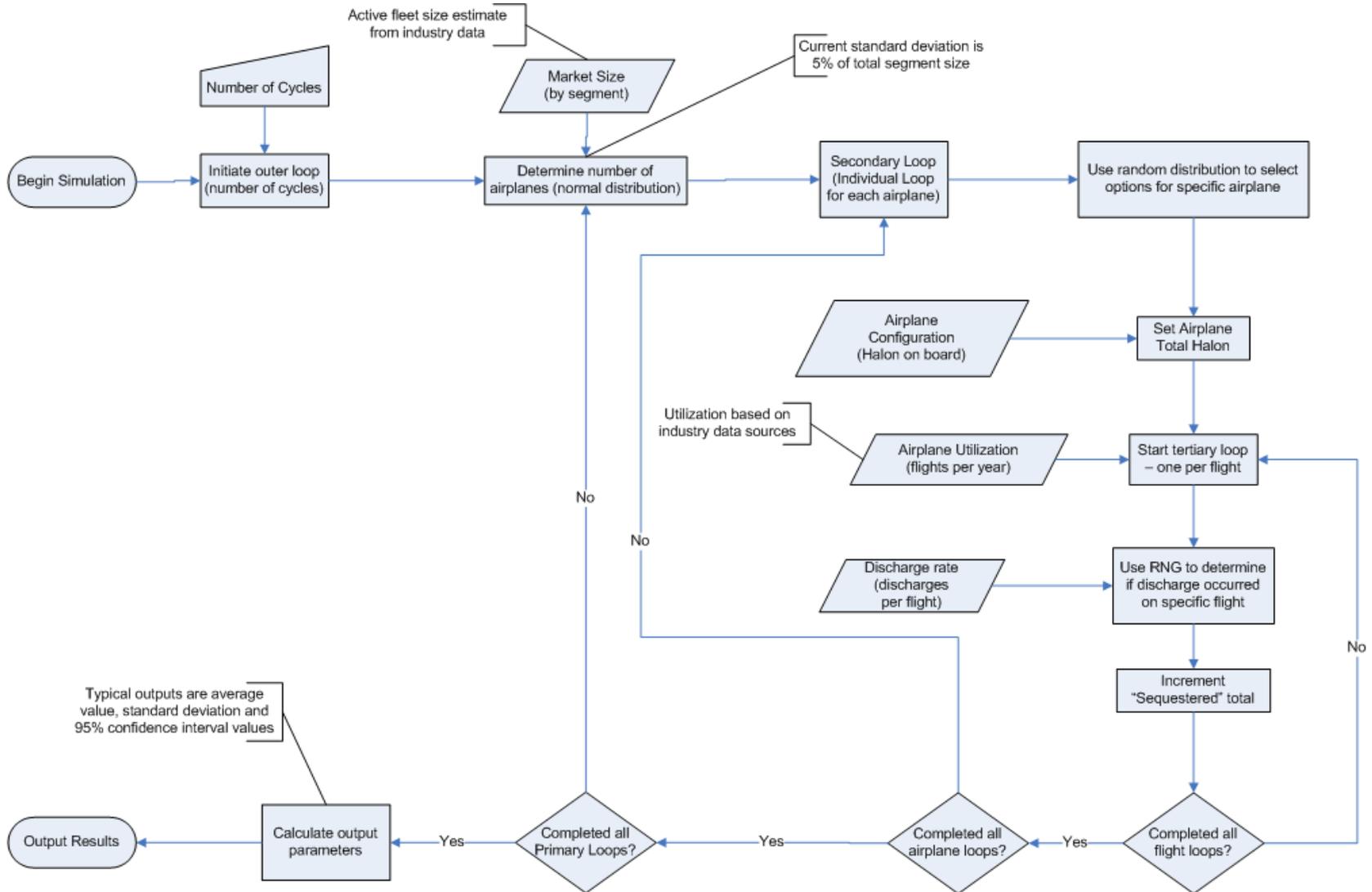
Total Halon 1301 Installed Base Procedure



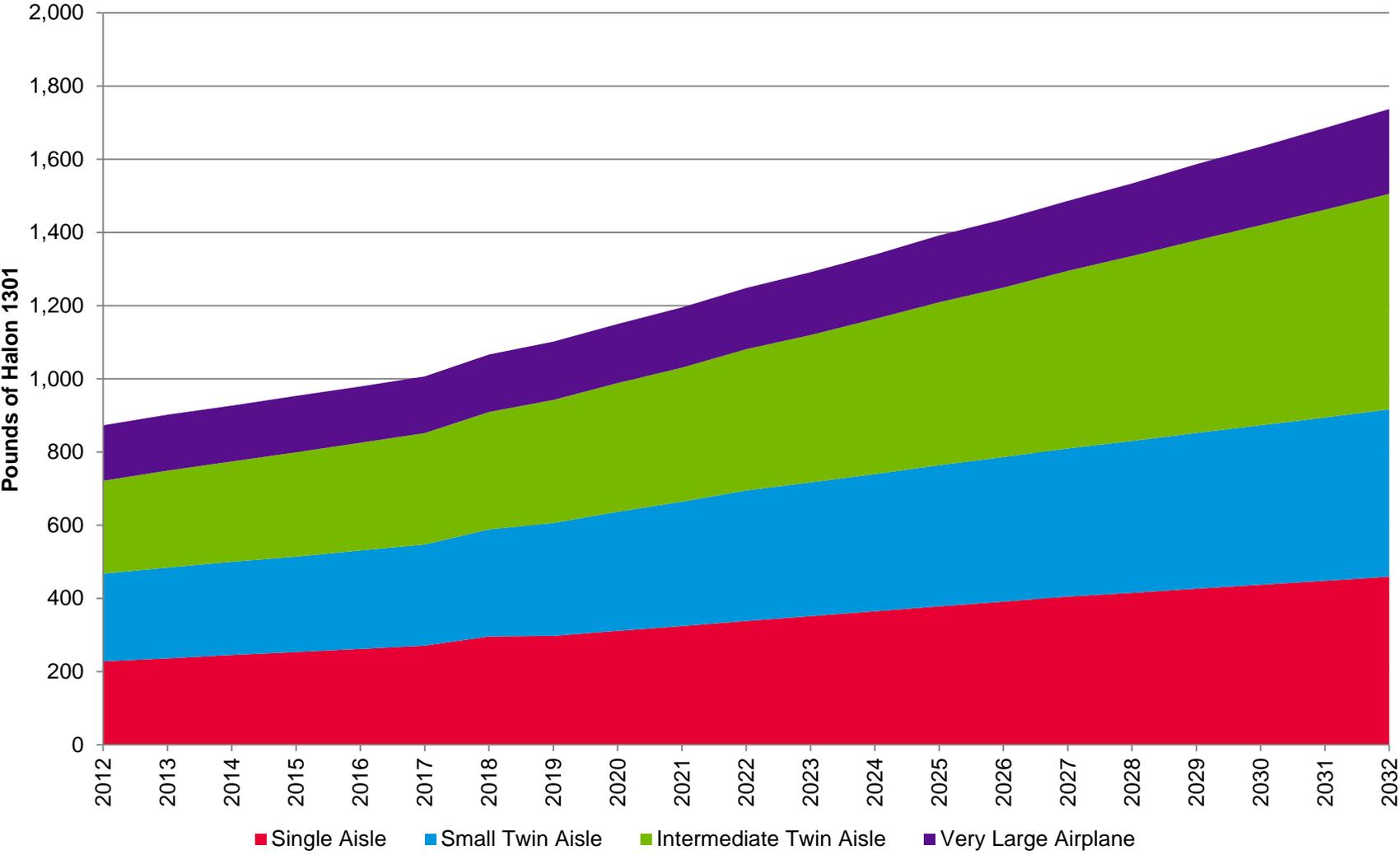
Total Halon 1301 Installed Base (Engines)



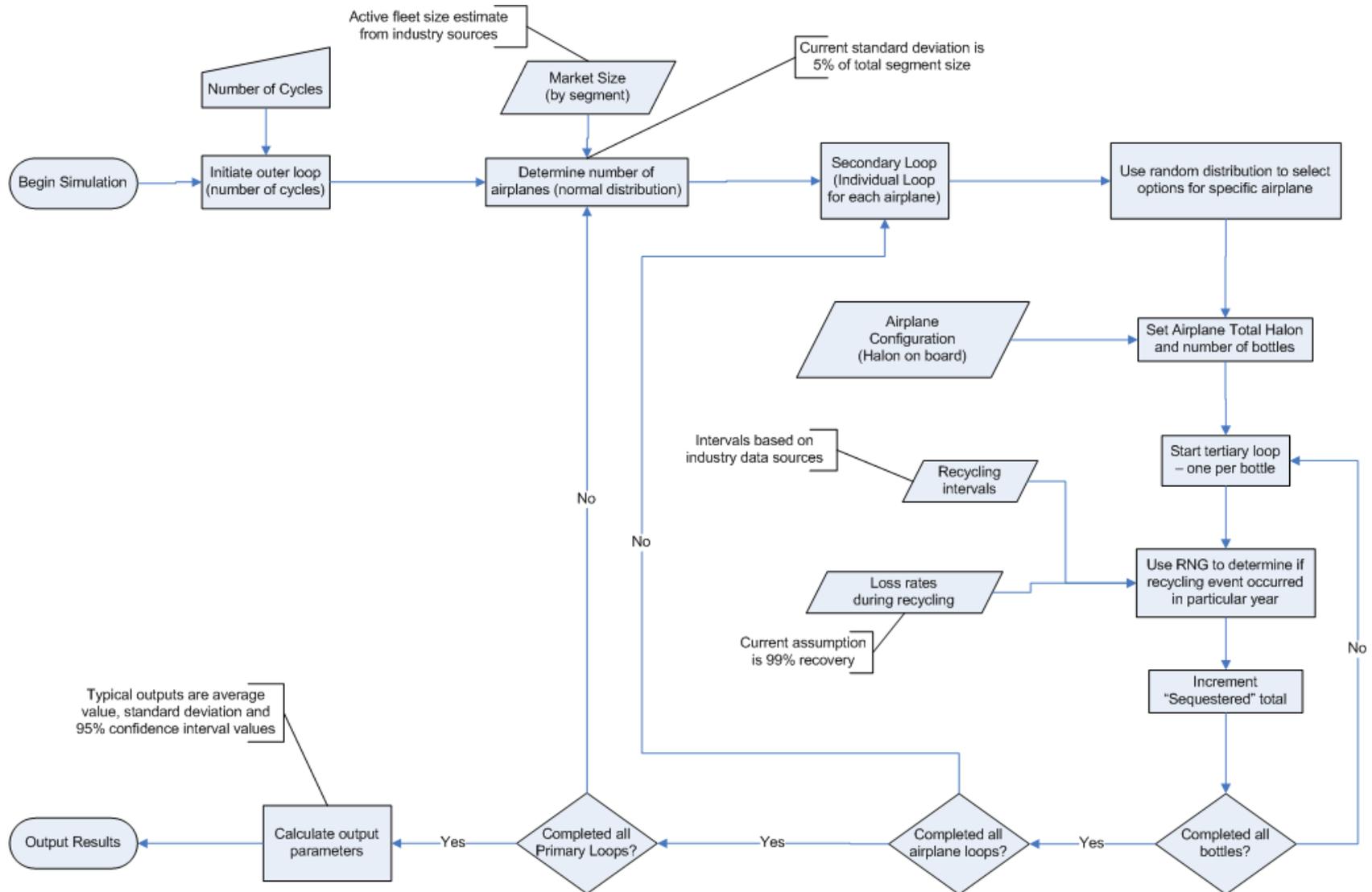
Total Halon 1301 Discharge Procedure



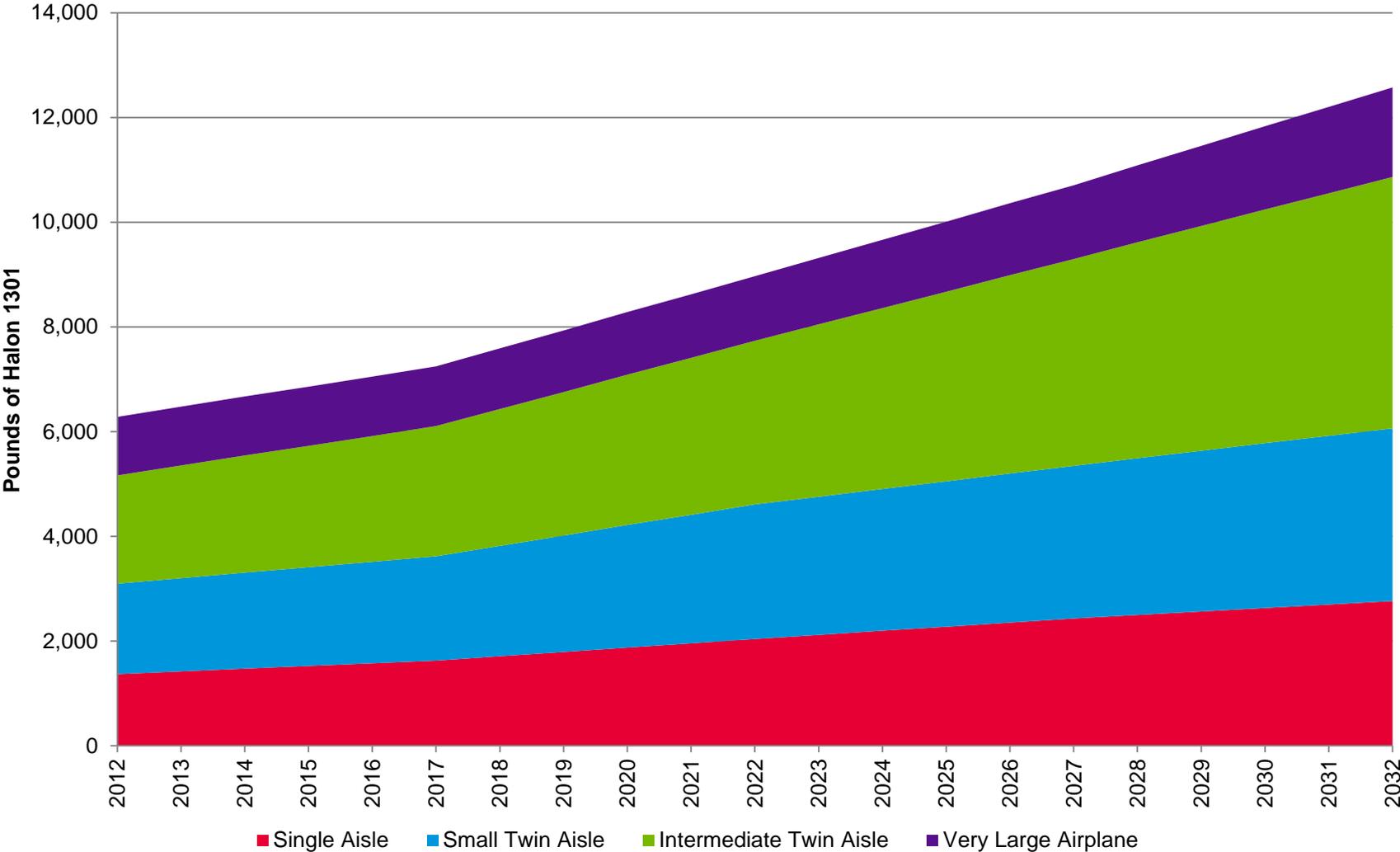
Total Halon 1301 Discharged (APU)



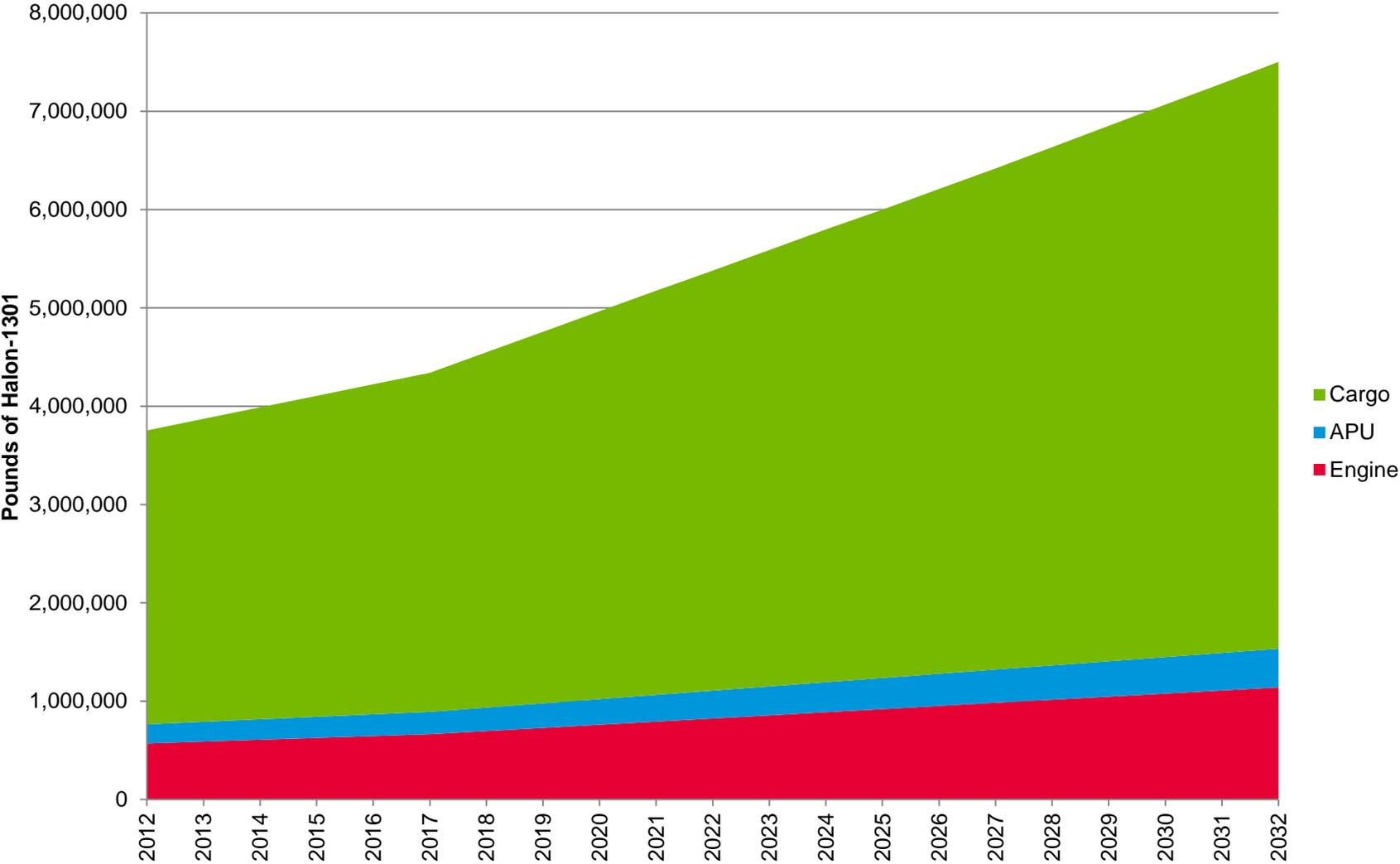
Total Halon 1301 Recycling Loss Procedure



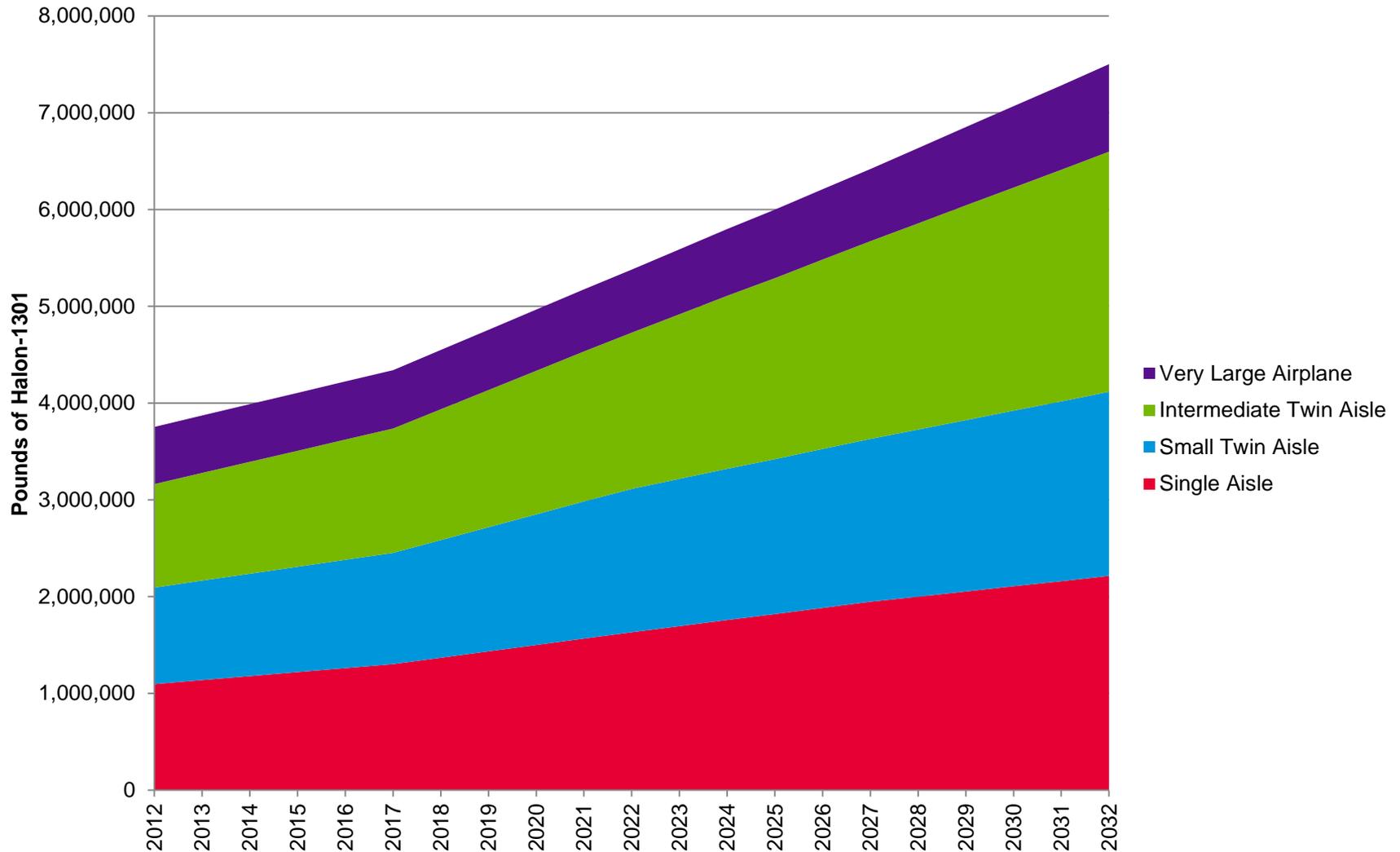
Total Halon 1301 Recycling Loss (Cargo)



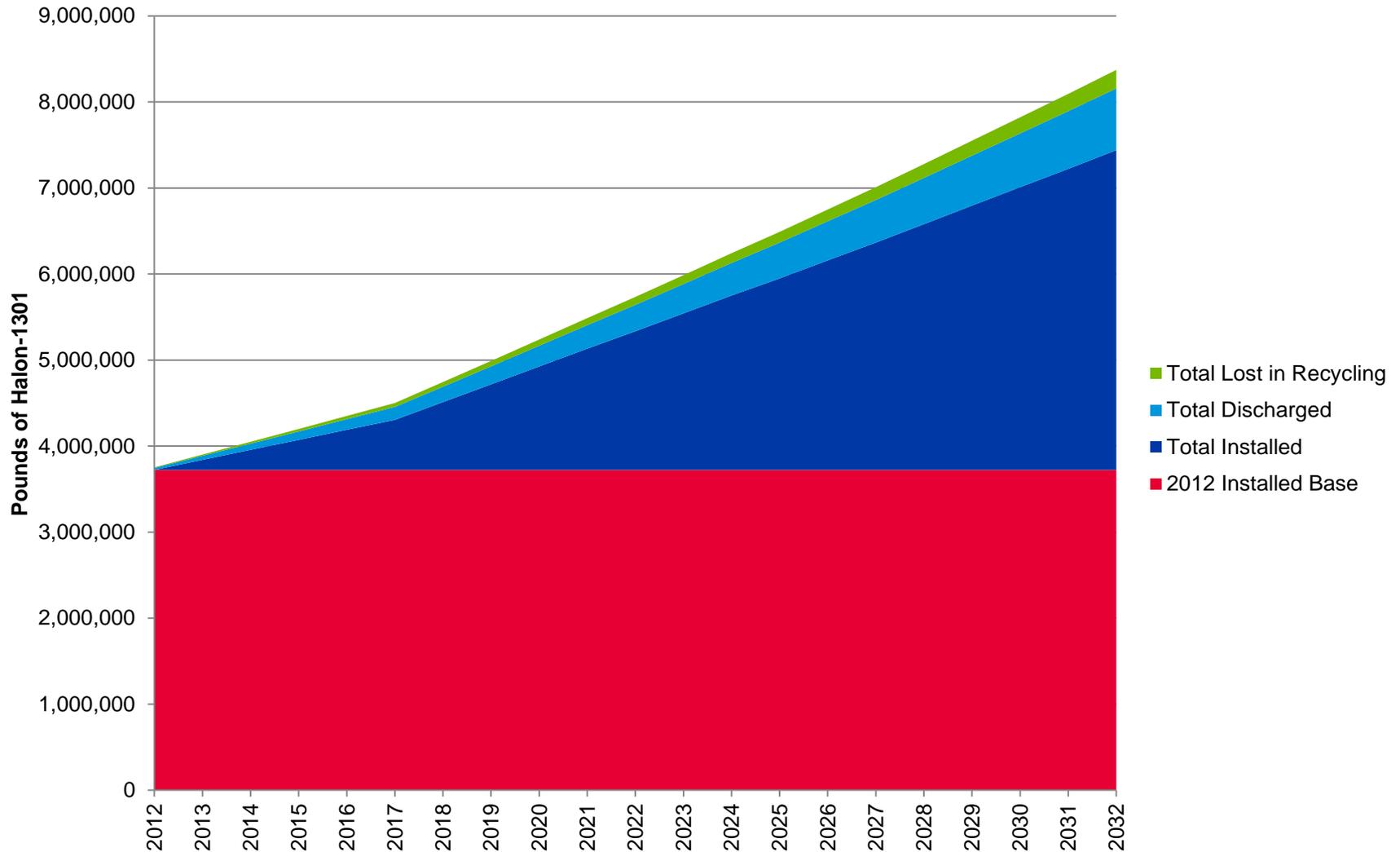
Total Halon 1301 Requirements by Application (Installed Base)



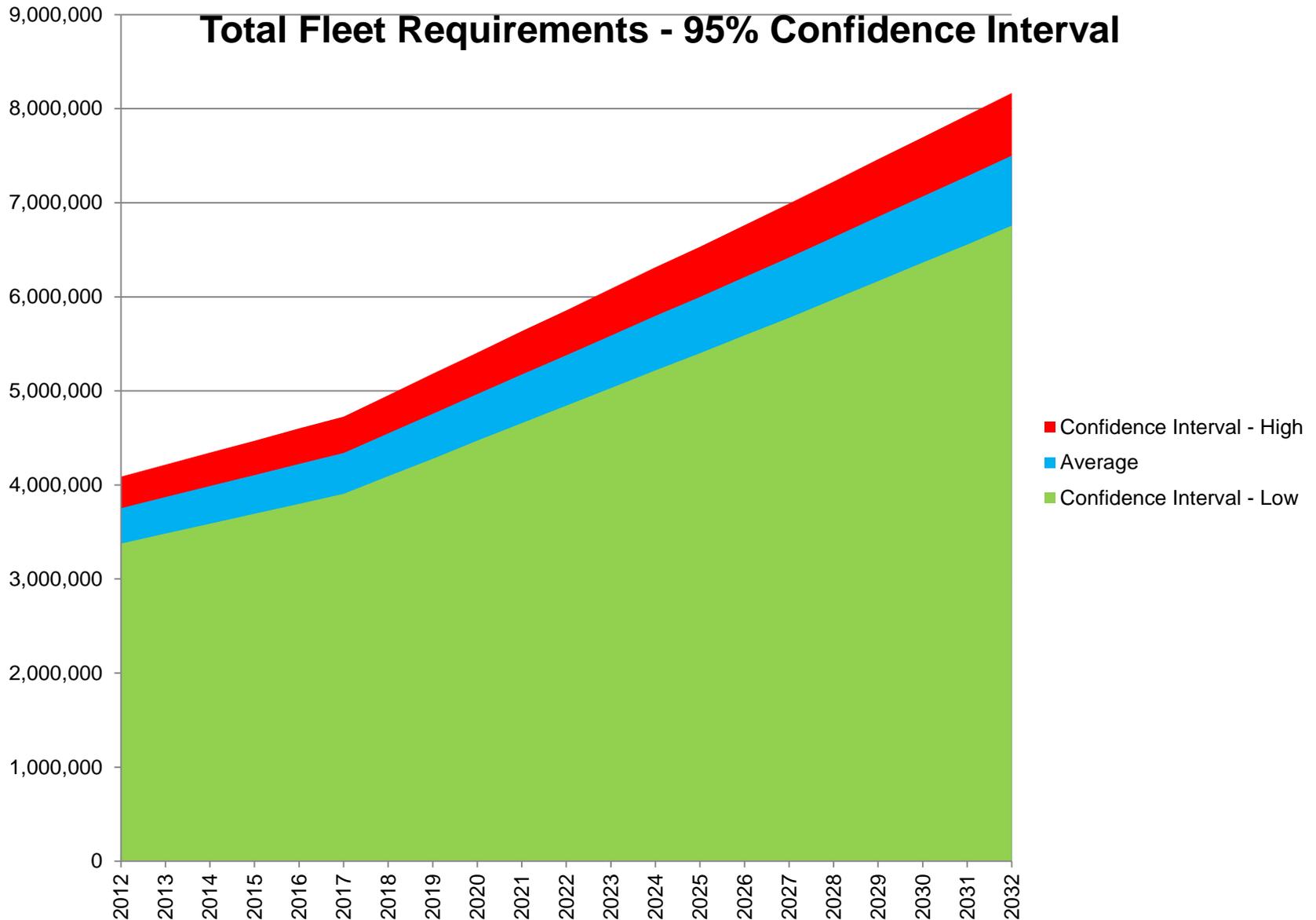
Total Halon 1301 Requirements by Market Segment (Installed Base)



Growth in Fleet Halon 1301 Requirements (Including Releases)



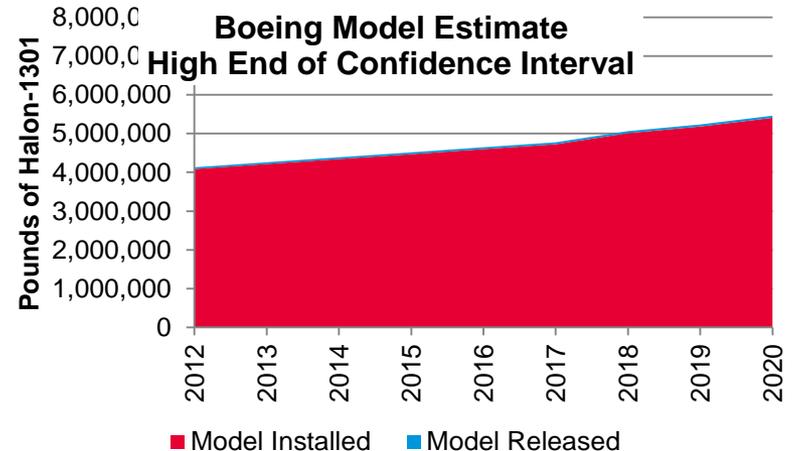
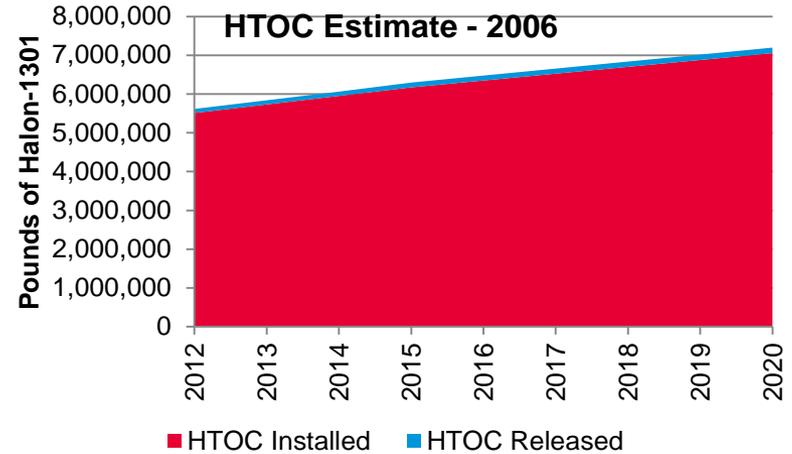
What's the Confidence?



Comparison – Boeing Model and HTOC Figures

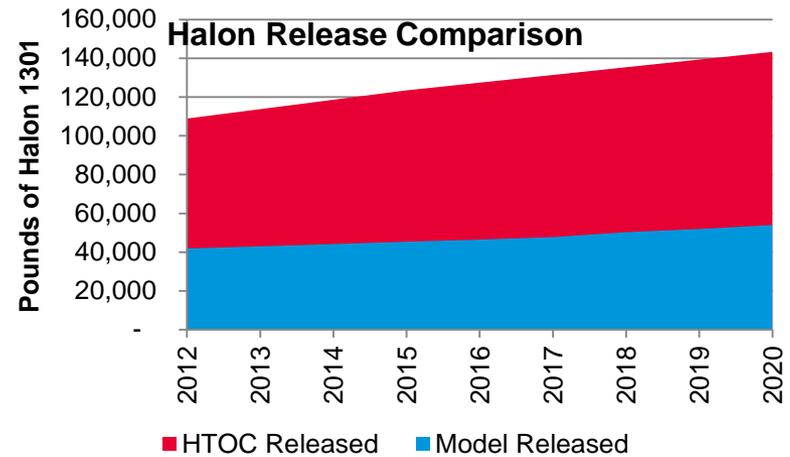
UNHTOC Estimate from 2010 – Same Data as 2006 Report

- HTOC estimates are consistently higher than Boeing estimates
- Boeing model is based on newer data regarding fleet size, airplane utilization and discharge rates
- Growth rates are similar ~1.5M pounds from 2012 to 2020
- Boeing model does not account for regional airliners



UNHTOC and Boeing Model Release Comparisons

- HTOC estimates are consistently higher than Boeing estimates
- Difference is more than 100% of Boeing model estimates
- UNHTOC growth rate is also higher
 - 40% over eight years
 - Boeing estimates 20% growth over eight years



Summary

- The installed base of Halon 1301 is expected to double over the next 20 years, assuming no replacement agents are fielded
- The growth in the installed base is four times the amount which will be released through discharges and recycling
- The amount of Halon currently installed in the active fleet will cover less than half of the needs of the fleet in 20 years
- Current UNHTOC estimates consistently track approximately one and a half million pounds above the amount estimated by the high end of the Boeing model estimates
- There are no large commercial airplanes announced which do not use Halon 1301 for engine, APU and cargo fire protection
- The demand for Halon will remain strong for the foreseeable future
- Future work on this model is not planned, as improving the input data and refining methodology would require significant effort, and the resulting changes would not likely alter the general conclusions

